

JAP6 Rec'd PCT/PTO 11 AUG 2006

## FREEZING FURNITURE AND AN INSERT THEREFOR

Technical Field of the Invention

In a first aspect, this invention relates to a piece of freezing furniture, which comprises a storage space, intended for products to be frozen, and a primary air duct, which partly surrounds said storage space and which comprises a suction duct, having an inlet that mouths at one side of the opening of the storage space, as well as a rising duct, having an outlet that mouths at the opposite side of said opening, and a temperature-change unit, which is located in the primary air duct and separates the suction duct from the rising duct and includes a fan, a heating element and a cooling element, wherein, in normal operation, cooled air flows from the temperature-change unit via the rising duct, over and past said opening, through the suction duct and back to the temperature-change unit.

Background of the Invention

In the food-distribution business, pieces of freezing furniture, such as freezing gondolas, freezing shelves, frozen food displays, etc., are utilized in order to store and offer frozen or deep-frozen foods. According to existing regulations, the temperature in such freezing furniture should advantageously be below -10 °C for frozen goods and -18 °C for deep-frozen goods, respectively. An important factor in the offer of the goods is that the piece of freezing furniture is partially open for a customer to easily be able to see the range of products and choose a specific package. However, this entails that the warm shop air can be mixed with the cold air in the piece of freezing furniture.

In order to maintain a low temperature in the storage space of the piece of freezing furniture, cooled air is circulated according to prior art around the same. The air is cooled down by a cooling element and a fan provides the necessary circulation. The air flows from the cooling element, which most often is located below the storage space, via a rising duct, over

and past the opening and past the foods placed in the storage space, down via a suction duct to the fan and then back to the cooling element. In this type of freezing furniture having circulating cooling air, it is inevitable that the cooling air 5 is mixed with the surrounding shop air, when the cooling air flows past the opening of the piece of freezing furniture. The surrounding air has higher air humidity, which entails that the cold, circulating air continuously is added a large quantity of moisture when the air masses are mixed. The moisture 10 condenses in the air duct and is deposited above all on the cooling element in the form of hoarfrost or ice, and will accordingly disturb the cooling function thereof. In order to remove the hoarfrost/ice and thereby maintain a satisfactory cooling production, it is required that the cooling element of 15 the piece of freezing furniture is defrosted either at regular intervals or when need arises.

In order to defrost the cooling element, one or more heating elements are used, which frequently are placed upstream the 20 cooling element in the airflow direction. According to prior defrosting methods, the fan continues to circulate the air via the same air duct as in normal operation, but upon defrosting, the heating element is activated at the same time as the cooling element is switched off. Thereby, the air is warmed up to 25 degrees above zero, the ice on the cooling element and on other surfaces melting. The meltwater formed is collected and allowed to run out via a drainpipe located at the bottom of the piece of freezing furniture and further to, for instance, a floor drain. A great disadvantage is that the entire circulating air mass has to be warmed up to degrees above zero in 30 order to get as efficient a defrosting as possible. The goods that are kept in the storage space will consequently be exposed to air temperatures exceeding 0 °C during a major part of the defrosting procedure. It has been shown that also a 35 short, applied heat shock on the surfaces of a merchandise may be very harmful, as the same is propagated through the entire frozen merchandise even if cold again is supplied to the surfaces. All air that circulates in conventional freezing furni-

ture may, as a consequence of the air being warmed up, in the final stage of a defrosting procedure, on the whole, be saturated by moisture. After initiated cooling production, this moisture will directly condense and become deposited on the 5 coolest surfaces, which is the cooling element, in the form of hoarfrost or ice, and will accordingly disturb the cooling function thereof. If ice is formed on the cooling element directly after a defrosting procedure, consequently the defrosting has, to a certain extent, been useless. Also the 10 goods placed in the storage space are still so cold in the final stage of the defrosting that the moisture-saturated air, upon contact with the goods, will become deposited on the same. This entails the troublesome drawback that when the goods are selected by a customer and transported through the 15 shop in a cart, the ice will melt and wet other goods in the cart.

Defrosting according to this technique usually takes place before the shop is opened and when the shop has been closed, 20 since the shopkeeper does not want that the customers should buy goods having a partly elevated temperature. An elevated temperature entails that the goods experience a shortened time window, during which the same should be transported out of the shop and further on to the home without risk of going bad. If 25 defrosting takes place before the shop is opened and when the shop has been closed, the goods will maintain satisfactory low temperature during the time the same are exposed for the customers. Due to long opening hours in a shop, up to 12 h or longer, much moisture has the time to become deposited on the 30 cold surfaces of the piece of freezing furniture, which is a reason why each defrosting may take long time, not rarely 0,5-1 h per occasion. Apart from the foods being exposed to harmful temperatures, it is also very energy demanding to warm up and cool the entire large circulating air mass, such as has 35 been described above, and to cool the circulating air in normal operation if the cooling element is ice-covered.

In order to manage the problem of allowing warm air to circulate around the entire storage space 1-2 h per day and thereby damage the food, many attempts have been made to allow the warm air, upon defrosting, to flow via other air ducts than  
5 those through which the cold air flows in normal operation. Freezing furniture having defrosting devices based on the use of a bypass are previously known by, among others, the publications DE 1 751 731, DE 19 810 232 A1, and DE 19 844 854 A1.

10 In the first-mentioned publication (DE 1,751,731), a defrosting device is presented that makes use of a bypass situated in the air duct. The bypass is open at both ends, in normal operation as well as during defrosting, which entails that in normal operation, a large quantity of the cooled air will take  
15 the short, simple way through the bypass and only circulate below the storage space of the piece of freezing furniture. Upon defrosting, the direction of rotation of the fan is changed and a damper closes the suction duct, after which the air flow is forced through the bypass, the outlet opening of  
20 which mouths in the rising duct. Since warm air has lower density than cold, the warmed air flow that leaves the bypass will rather rise up through the rising duct than fall down to the temperature-change unit, at the same time as cold air will be drawn down through the rising duct in exchange for the  
25 warm, rising air. If defrosting takes place during the shop's opening hours, the goods will be exposed to a temperature rise, such as in the above-described prior art. Thus, the presented device provides a less efficient defrosting procedure as well as a clearly deteriorated circulation of cooled air in  
30 normal operation.

Also the two last-mentioned publications (DE 19,810,232 A1 and DE 19,844,854 A1) disclose devices comprising bypasses located in the air duct. In contrast to DE 1,751,731, each of these  
35 publications shows that an end of the bypass is possible to open and close by means of a damper, cooled air being forced to pass through the ordinary air duct in normal operation. Furthermore, the inlet of the suction ducts and the outlet of

the rising ducts are also provided with dampers, which are closed upon defrosting at the same time as the dampers of the bypasses are opened. Thus, the warm air can only circulate through the bypass during a defrosting procedure, but since  
5 the dampers in the suction ducts and the rising ducts are located at the inlet and outlet thereof, respectively, also the last-mentioned ducts will be filled with warm air during the defrosting, and consequently it is still a very large air mass that is to be warmed up. Furthermore, in normal operation  
10 it is utmost important that the air flow leaving the outlet of the rising duct is not too turbulent and that the same leaves the outlet at a determined angle, in order to, in a reliable way, flow over and past the opening of the storage space to the opposite side. In the inlet of the suction duct, similarly  
15 it is important that nothing disturbs or blocks the air flow from being sucked down into the duct. Thus, it is not very functional, as is shown in the mentioned publications, to locate a number of coarse dampers on these locations. The dampers may even cause that the cooled air is mixed with the  
20 surrounding shop air to a higher extent than previously. It may be that the dampers in the disclosed devices fulfil the functions thereof during defrosting to an acceptable degree, but risk to create large operational disturbances in normal operation.

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#### Objects and Features of the Invention

The present invention aims at obviating the above-mentioned disadvantages of previously known freezing furniture and at providing an improved piece of freezing furniture. Thus, a  
30 primary object of the invention is to provide a piece of freezing furniture that can be defrosted whenever need for defrosting arises without damaging the goods stored in the storage space by warming and thereby causing drawbacks for the customers. It is also an object to provide a piece of freezing  
35 furniture that does not disturb the air flow in normal operation and thereby guarantees satisfactory function. An additional object is to provide a piece of freezing furniture that saves energy by efficient defrosting. An additional object is

to provide a piece of freezing furniture having a defrosting device in the form of an insert that can be installed in an existing piece of freezing furniture. It is also an object to provide a piece of freezing furniture having a defrosting 5 device that includes few movable parts, in order to minimise the risk of operational disturbances and malfunctions.

At least the primary object is attained by means of the piece of freezing furniture defined by way of introduction, which is 10 characterized in that the same comprises an insert placed in the primary air duct, which insert comprises a secondary air duct having, on one hand, an inlet opening, which mouths in the primary air duct downstream the temperature-change unit, and is possible to open and close by means of a damper having 15 double-acting function, and on the other hand an outlet opening, which mouths in the primary air duct upstream the temperature-change unit. Adjacent to said outlet opening a guiding means may advantageously - though not necessarily - be arranged, with the purpose of guiding the air flow, which 20 leaves said outlet opening, in the direction of the temperature-change unit and on the outside of the insert toward said inlet opening. Preferred embodiments of the invention are further seen in the dependent claims 2-8, and in the subsequent detailed description.

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In a second aspect, the invention also relates to an insert that is distinguished by the features defined in the characteristic part of the independent claim 9.

30 Brief Description of the Appended Drawings

In the drawings:

Fig. 1 is a perspective view of a piece of freezing furniture,

35 Fig. 2 is a cross section of a piece of freezing furniture according to the invention,

Fig. 3 is an enlarged, cut detailed view of the damper in a first position,

- Fig. 4 is a detailed view, corresponding to figure 3, of the damper in a second position,
- Fig. 5 is an enlarged, cut detailed view of an alternative embodiment of the damper in the first position,
- 5 Fig. 6 is a detailed view, corresponding to figure 5, of the damper in the second position,
- Fig. 7 is an enlarged, cut detailed view of an additional alternative embodiment of the damper in the first position, and
- 10 Fig. 8 is a detailed view, corresponding to figure 7, of the damper in the second position.
- Fig. 9 is an enlarged, cut detailed view of an alternative embodiment of the damper in a first position,
- Fig. 10 is a detailed view, corresponding to figure 9, of the
- 15 damper in the second position.

#### Detailed Description of Preferred Embodiments of the Invention

In figure 1, a conventional piece of freezing furniture 1 is shown, of the type that is used in retail shops for the storage and offering of frozen and deep-frozen foods 2. In the example shown, the piece of freezing furniture 1 consists of a single freezing gondola, but also double freezing gondolas, freezing shelves, frozen food displays, etc., are included in the concept of piece of freezing furniture. According to existing regulations, the temperature in such freezing furniture 1 should, for frozen goods, be below -10 °C, and for deep-frozen goods -18 °C.

Now reference is made also to figure 2. The piece of freezing furniture 1 shown comprises a storage space 3, which is open upward so that a customer should have unimpeded access to the goods 2 placed, and thereby offered, in the storage space 3. Furthermore, the piece of freezing furniture 1 comprises a large, primary air duct in its entirety designated 4, which is defined inward by the walls 5, 6 and floor 7 of the storage space 3 and outward by the outer walls 8, 9 and bottom 10 of the piece of freezing furniture 1. The primary air duct 4 consists of a suction duct 11 having an inlet 12, which mouths at

one side of an access opening 13 of the storage space 3, and a rising duct 14 having an outlet 15, which mouths at the opposite side of said access opening 13. A temperature-change unit 36 is located in the primary air duct 4 and separates, or  
5 forms a borderline, between the suction duct 11 and the rising duct 14. In other words, the primary air duct 4 has a suction side and a rising side, which are spaced apart by the temperature-change unit 36. The temperature-change unit 36 includes a fan 16, a heating element 17 and a cooling element 18, which  
10 are placed one after the other in the primary air duct 4. It should be pointed out that the heating element 17 as well as the cooling element 18 may consist of one or more part elements without affecting the general idea according to the invention. Analogously, also the fan 16 may consist of one or  
15 more part fans. Also their mutually position lacks significant importance to the common purpose.

In normal operation, i.e., in cooling production, the heating element 17 is inactive and the cooling element 18 is active,  
20 the fan 16 providing an air flow, which is cooled by the cooling element. The cold air flow is brought to circulate via the rising duct 14, over and past the opening 13, down through the suction duct 11 and back to the temperature-change unit 36. By virtue of cold air having higher density than warm, the cooled  
25 air will by its own weight fall down into the storage space 3 and thereby cool the goods 2, as well as form a "lid" in the opening 13 against the surrounding warm shop air. The circulating cold air also cools the storage space 3 and the goods 2, when the same are in the rising duct 14 and the suction  
30 duct 11, namely via the walls 5 and 6, which preferably are made of thin sheet metal or glass.

In spite of the cold air in the storage space 3 being heavier than the shop air, yet a mixture takes place between the two  
35 air masses due to the turbulence that arises in the air in the shop when customers pass the piece of freezing furniture 1 or pick up goods 2 out of the same. When the warm air, which contains more moisture than cold air, follows the air mass circu-

lating in the piece of freezing furniture 1, the supplied moisture will condense and become deposited on the cold surfaces in the primary air duct 4 in the form of hoarfrost and/or ice. This takes place, above all, on the cooling element 18 and the flanges thereof. Smallest possible deposit of ice on the cooling element 18 affects the cooling production in a negative way, with additional energy consumption as a consequence as well as risk of relatively high temperatures of the circulating air mass.

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In order to initiate defrosting of the cooling element 18 primarily, but also other cold surfaces in the primary air duct 4, a signal about that has to be received. This signal may, for instance, be given manually or automatically when need arises and/or at regular time intervals. The defrosting signal activates the heating element 17 and inactivates the cooling element 18 simultaneously. The initiation signal also actuates a damper 19, which opens a secondary air duct 20. Also during defrosting, the fan 16 continues to circulate the now-warm air in the same direction as the cold air is circulated in normal operation, but through the short secondary air duct 20 instead of the long, primary air duct 4. The secondary air duct 20 comprises, on one hand, an inlet opening 21 possible to open and close by means of the damper 19, which inlet opening mouths in the primary air duct 4 downstream the temperature-change unit 36, and on the other hand an outlet opening 22, which mouths in the primary air duct upstream the temperature-change unit. When the damper 19 opens said inlet opening 21, simultaneously the same closes the rising duct 14 between the wall 5 and the wall 8. In other words, the damper 19 is movable between a first position, in which the inlet opening 21 of the secondary air duct is kept closed and the rising duct 14 of the primary air duct is kept open, and a second position, in which the inlet opening 21 is kept open and the rising duct 14 is kept closed.

Thanks to the damper 19, during defrosting the air flow is forced to flow via the short way through the secondary air

duct 20 and toward the outlet opening 22 thereof. At the outlet opening 22, in the shown preferred embodiment, a guiding means or a baffle 23 is arranged, which compulsorily guides the air flow leaving said outlet opening 22 in the direction of

5 the temperature-change unit 36 and toward said inlet opening 21. The baffle 23 extends into the primary air duct 4 and forward in the airflow direction, more precisely toward the temperature-change unit 36. In a preferred embodiment, the baffle 23 is slightly deflected so that the free end thereof points

10 in the direction of the temperature-change unit 36 in order to smoothly direct the air flow in the desired direction, but the baffle 23 may also be manufactured from a flat plate that extends obliquely inward/forward. It should be pointed out that the distance between the free end and bottom 10 of the

15 baffle 23 should be at least as large as the width of the suction duct 11, which entails that the baffle 23 does not disturb the air flow in normal operation. In spite of the fact that the air circulated via the secondary air duct 20 during defrosting is warm and thereby has lower density than the air

20 still being cold, which stands still in the suction duct 11, the design of the baffle 23, the fan 16, and the mass inertia of the air entail that only a very small quantity of warm air rises up through said suction duct 11. The shorter way that the air has to pass during defrosting entails that a smaller

25 quantity of air has to be warmed up than in previously known devices, which gives savings of energy. When the ice melts, meltwater is formed, which is led to a drainpipe 24, which is located in the bottom 10 of the piece of freezing furniture 1, and further to, for instance, a floor drain in the shop (not

30 shown).

The defrosting continues until a cooling production signal is given manually or automatically after accomplished operation and/or after a time determined beforehand. On that occasion,

35 the cooling element 18 is activated again and simultaneously the heating element 17 is inactivated. After a cooling production signal has been given, it takes a while before the air mass again has attained a sufficiently low temperature in

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order not to damage the goods 2. Therefore, the damper 19 should be kept in the second position also during a time determined beforehand after the signal has been given, or until the air again has been cooled to a desired level.

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A piece of freezing furniture 1 should, to the largest part of the length thereof, comprise a secondary air duct 20 in order to obtain an efficient defrosting. Preferably, along more than 75 % of the length thereof, most preferably more than 85 %.

- 10 The parts of the length of the piece of freezing furniture 1 that do not comprise a secondary air duct 20, due to supporting stays and/or other components, have to be sealed at the lower part of the rising duct 14, both in normal operation and during defrosting, so that cooled air should not take the  
15 short way via the secondary air duct 20 or that warm air should rise up through the rising duct 14.

Now reference is made also to figures 3 and 4. In a preferred embodiment, the damper 19 is movable between the first position and the second position by being turnable around a joint 25. The damper 19 consists of a damper plate 26 and a sealing strip 27. Said joint 25 consists of a flexible material 28, which extends between a fastening plate 29 and the damper plate 26. The flexible material 28 may have a waist or a notch 25 in order to facilitate the turning of the damper 19. The flexible material 28 may, for instance, be a plastic or a preferably airproof textile, which during defrosting can contribute to seal the rising duct 14. In the first position of the damper 19, the sealing strip 27 closes the inlet opening 30 21 of the secondary air duct 20. In the second position of the damper, the sealing strip 27 abuts against the wall 8, in addition to which the damper plate 26 screens off the major part of the rising duct 14 and the flexible material 28 seals between the damper plate 26 and the wall 5, either directly or  
35 via a spacer 30.

The damper 19 is actuated by a spring 31, which always aims to hold the same in said first position. Between the damper plate

26 and the wall 5, one or more flexible bladders 32 are arranged, which are possible to fill with a pressurized fluid from a fluid source (not shown) connected to the same, in order to, in the filled state, bring the damper 19 to said second position. The access of the fluid to the bladder/bladders 32 may, for instance, be controlled by a valve (not shown), which is activated by the above-described defrosting signal or as a consequence thereof.

- 10 The bladder 32 may be made by extrusion of, for instance, a plastic and may, in addition to a casing for the proper fluid, also include a lip (not shown), which is fixed under the fastening plate 29, so that the bladder 32 should not be pressed out from the position thereof when the same is filled. Each 15 bladder 32 may also be accommodated in an air-permeable bag (not shown), the upper part of which is fixed under the fastening plate 29. In this case, the bag should be air permeable since it should not expand if the bladder 32 breaks. In the embodiment shown in figures 3 and 4, the bladder 32 is fixed 20 on the damper plate 26 and the wall 5 by means of an adhesive or a double-stick tape. The bladder 32 may consist of a plurality of part bladders, spaced-apart along the length of the piece of freezing furniture 1, each one of which part bladders has a small extension, or of a smaller number of elongate part 25 bladders. In the case of a plurality of part bladders, the springs 31 should be arranged just opposite the same so that the damper 19 should not be deflected along the length thereof and thereby not in full carry out the function thereof.
- 30 Now reference is made to figures 5 and 6. In this alternative embodiment, the damper consists of a plate 33, which preferably is manufactured from a relatively stiff plastic, as well as one or more flexible bladders 32. Also in this alternative embodiment, the plate 33 may preferably be provided with a 35 waist or notch, at which the same can be deflected. One part of the plate 33 is attached to the wall 5 and one part is arranged to close the inlet opening 21, when the damper is in the first position. On the side of the plate that faces inward

toward the rising duct 14, the flexible bladder 32 is arranged by means of an adhesive or a double-stick tape. Said bladder 32 is possible to fill with a pressurized fluid such as has been described above. When the bladder/bladders 32 is/are in  
5 the unfilled state, the inherent stiffness of the plate 33 aims to bring the damper to the first position, and in the filled state, the inlet opening 21 is opened at the same time as the bladder 32 abuts against the wall 8 and thereby closes the rising duct 14. It should be pointed out that the flexible  
10 bladder 32 has to extend along the entire length of the rising duct 14 of the piece of freezing furniture that should be closed during the defrosting procedure, in order to achieve requisite seal.

15 Now reference is made to figures 7 and 8, which show an additional alternative embodiment of the damper. In this case, the damper is movable between the first position and the second position by being slid able at an angle to the rising duct 14, for instance, by means of a piston-cylinder mechanism 34. The  
20 displacement of the damper may also be effected by, for instance, a gear rack, a belt drive or the like. When the damper is in the first position, the damper plate 26 overlaps the inlet opening 21, and when the damper is in the second position, a sealing strip 27 seals against the wall 8 at the  
25 same time as the damper plate 26 screens off the rising duct 14 and a number of holes or openings in the damper plate 26 end up in flush with the inlet opening 21.

Now reference is made to figures 9 and 10, which show yet an  
30 alternative embodiment of the damper. In this case, the damper is made in accordance with the technique in figures 3 and 4, as well as supplemented by a rear damper wall 38, which has one or more openings 39 along the length extension thereof. The openings 39, which may be round, rectangular or of another  
35 shape, constitute a substantial part of the area of the damper wall 38, in order to thereby give a minimal form resistance to the circulating air flow via the rising duct 14 in normal operation. On the damper wall 38, a seal 40 is applied that

seals against the outer wall 8 of the piece of freezing furniture. In the first position of the damper 19, the inflow to the secondary air duct 20 is closed according to the prior presentation.

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In this connection, the air flow to the rising duct 14 passes through the openings 39 in the damper wall 38.

10 In the second position thereof, the damper 19 co-operates with the rear damper wall 38, the openings 39 being covered by the damper 19, whereby the rising duct 14 is closed, at the same time as the secondary air duct 20 is opened.

15 Installation of the Insert According to the Invention in an Existing Piece of freezing furniture

The insert according to the invention is easily installed in an existing piece of freezing furniture 1. Probably, these pieces of freezing furniture 1 have no dampers or secondary air ducts, but the air circulates the same way during defrosting as in normal operation. In the subsequent description, reference is made to figures 1 to 4, as well as 9 and 10, which show preferred embodiments of the invention. However, similar reasoning may be conducted for alternative embodiments of the damper 19.

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A traditional piece of freezing furniture 1 includes a number of transverse sections along the length thereof. The piece of freezing furniture 1 in figure 1 comprises six, but it should be understood that the number of sections may be greater as well as smaller. Frequently, each section comprises a separate floor plate or a floor 7 of its own. Each floor plate 7 rests on angle elements 35, which are arranged in the lower ends of the walls 5 and 6 of the storage space 3, and which extend in the direction of each other. The floor 7 is insulated or consists in its entirety of an insulating material, in order to protect the goods 2 from the warm air during defrosting. The desired number of bottom plates 7 are lifted out and the corresponding parts of the wall 5 are disassembled from the piece

of freezing furniture 1. Next, the damper 19 is mounted on the side of the wall 5 that faces the primary air duct 4, by means of a fastening element, for instance, a screw, a pop rivet, etc., which fixes the flexible material 28 between the fastening plate 29 and the wall 5. The bladder 32 is connected to a fluid source (not shown), which is installed in a suitable place adjacent to the piece of freezing furniture 1. One and the same fluid source may serve one or more cross sections and/or pieces of freezing furniture 1. The fluid may be a gas, for instance, very dry air or a liquid, for instance, suitable hydraulic oil. Near the angle element 35, a number of holes or openings are recessed, along the length of the piece of freezing furniture 1 that is to be provided with the insert. The holes or the openings together form the inlet opening 21. The wall 5 is then mounted again in the piece of freezing furniture 1. The sections of the rising duct 14 that should not contain an insert are provided with screening plates, which coincide with the damper 19 when the same is in the second position, so that no warm air can rise up through the rising duct 14 during defrosting. The wall 6 is entirely unaffected by the reconstruction. The insert according to the invention is then placed on the angle elements 35.

The insert comprises a secondary air duct 20, which is formed by a box having rectangular cross section. The floor 7 is then placed on top of the insert. The insert may also be of a cross section-wise U-shape, having a relatively large bottom 37, in this case the secondary air duct 20 is formed not until the floor 7 is placed on top of the insert, in other words the floor 7 forms the upper delimitation of the secondary air duct 20 and the bottom 37 the lower one. The insert is entirely open in the end that faces the rising duct 14, or holes or openings are arranged that entirely or partly correspond with the holes or openings that are arranged near the angle element 35 in the wall 5. In the other end of the insert, an outlet opening is arranged that consists of a number of holes or openings arranged in the bottom 37 of the insert, near the wall 6. In the immediate vicinity of said outlet opening 22, a

baffle 23 may be arranged, which compulsory guides the air flow in the desired direction.

#### Advantages of the Invention

- 5 A primary advantage of the piece of freezing furniture according to the invention is that the same has a double-acting damper and a separate air duct for warm air during defrosting, which results in that defrosting of the piece of freezing furniture can be effected whenever need arises, without damaging  
10 the goods placed in the piece of freezing furniture by warming and thereby causing drawbacks for the customers. An advantage of the fact that defrosting can be effected independent of time is that the cooling production and the air circulation in normal operation can be effected in a more efficient way,  
15 which results in less energy consumption. Another advantage of the piece of freezing furniture according to the invention is that the warm air during defrosting only needs to circulate a short distance, and thereby a much smaller quantity of air needs to be warmed up, which together with the circulating air  
20 not being mixed with other air results in a faster defrosting procedure and the same higher efficiency gives savings of energy. An additional advantage of a smaller quantity of air having to be warmed up is that a smaller quantity of moisture can be absorbed and thereby deposited upon initiation of the  
25 cooling production. Consequently, an energy efficient defrosting procedure is obtained, which is not harmful to the goods placed in the piece of freezing furniture.

#### Feasible Modifications of the Invention

- 30 The invention is not only limited to the embodiments described above and shown in the drawings. Thus, the piece of freezing furniture as well as the insert may be modified in various ways within the scope of the appended claims. For instance, it is feasible to let the damper be actuated by a bimetal instead  
35 of a fluid bag. A bimetal changes shape at a temperature determined beforehand and moves thereby the damper compulsory from the first position to the second when the temperature rises above the threshold value, and back from the second

position to the first when the temperature falls below the threshold value as a consequence of re-initiated cooling production. By means of a well-chosen bimetal, the threshold temperature may be set so low that the rising duct is closed at 5 an early stage of the defrosting procedure and is opened again not until the air mass circulating in the secondary air duct has obtained a sufficiently low temperature, in order not to be harmful to the goods. The control of the damper may also be effected by means of a closed fluid-filled bellows, which is 10 mounted on a heating plate, which is activated when the heating element is activated. The heating plate of the bellows generates heat, which results in the fluid in the bellows expanding, and thereby the bellows being given a motion that can be transferred to the damper that closes the rising duct, 15 or the bellows closes the rising duct by itself. The fluid has an inherent cooling inertia, which means that when the heating plate is inactivated, a delay arises before the bellows returns to the original shape thereof. This time may be extended by the fact that the heating plate is active during a 20 longer time than the heating element.

An additional alternative embodiment to manoeuvre the damper is via an electromagnet, where the core of the electromagnet is mechanically connected to the damper. Upon defrosting, current is connected to the electromagnet, the damper changing 25 position from the first position thereof to the second position thereof. When the defrosting is ready, the current to the electromagnet is disconnected and the damper resumes the first position thereof.

30 It should also be mentioned that the baffle or the guiding means is not of a decisive importance for the function of the invention. Designs of freezing furniture may be found where the guiding means cannot be applied due to lacking space, or 35 where the basic construction of the piece of freezing furniture is of such a kind that the guiding means function can be obtained by means of an existing mechanical configuration. If the guiding means for some reason is not applied, it may

entail that the efficiency of the defrosting is decreased to some extent.

- In the example shown in the drawings, the storage space is open upward, but it should be pointed out that in, for instance, freezing shelves, the storage space is, however, open sideways, in order to enable access to the goods placed on the shelves. Upon defrosting of freezing shelves and upright cabinet freezers, i.e., freezing shelves having doors, it is utmost important that the warm air does not circulate along the same ducts as the cold air in normal operation, since the cold air, in addition to the circumferential circulation, also flows along each shelf from holes located in the rear edge thereof to the front edge thereof. As a consequence of warm air being allowed to flow in this conventional way between the frozen goods, accordingly the same run a great risk of going bad due to the defrosting procedure. A separate duct for warm air entails that this risk does not arise.
- The fan in an existing piece of freezing furniture may also be reversible in such a way that it changes the direction of rotation upon the transition between normal operation and defrosting. In that case, the insert is inserted reversely, i.e., the inlet opening of the secondary air duct mouths in the suction duct and the outlet opening mouths in the rising duct.

In conclusion, it should be pointed out that the drawings are not proportionate, but have a schematic character, and that there also exist pieces of double freezing furniture having two separate suction ducts and a common rising duct. If so, the outer wall in the rising duct of the individual piece of freezing furniture is replaced by a low wall, which extends from the bottom of the piece of freezing furniture up into the rising duct to a height that is on a level above the point where the seal of the damper wall, or the damper, abuts against the same, when the damper is in the second position.